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INCIDENCE OF USAGE OF DIFFERENT MEMBRANES IN IMPLANT DENTISTRY

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ABSTRACT

INTRODUCTION: Dental implants are newly advanced technology used for inert, alloplastic materials which are embedded in the maxilla and/or mandible for the management of tooth loss and to aid replacement of lost orofacial structures as a result of trauma, neoplasia and congenital defects to the patient. neoplasia and congenital defects.

MATERIALS AND METHODS; It is a single centered retrospective study conducted in a private dental institution, Chennai. The data was collected from the dental hospital management system. 20,000 patient details were analysed between September 2020 to January 2021 out of which 133 patients who fulfilled the inclusion and exclusion criteria were included in the study. Ethical clearance for this study was obtained from the Institutional review board.

RESULTS: The maximum amount of membranes used was in the upper arch. With a total of 37.12% for Periocol followed by Jason membrane 19.70% . On the other hand, 25.76% was the usage of Periocol membrane making it the lower arch best option for the choice of membrane barrier in case of implant dentistry. The membrane placement in case of male was more when compared to females with a total of 50.76%.

CONCLUSION: From the study, it can be concluded that GBR is a widely used procedure during the course of implantation. Usage of membranes to a higher extent was appreciated more on the upper arch when compared to the lower due to the fragility of the alveolar bone. Periocol membranes are maximum used followed by Jason membranes because of its remarkable property of structural integrity and biocompatibility. There is a need for further research in this avenue of implantology to design a customised therapy.

KEYWORDS- Periocol, Jason membrane, Implant stage 1 surgery, biocompatibility, GBR technique, Novel study

INTRODUCTION

Dental implants are newly advanced technology used for inert, alloplastic materials which are embedded in the maxilla and/or mandible for the management of tooth loss and to aid replacement of lost orofacial structures as a result of trauma, neoplasia and congenital defects to the patient. neoplasia and congenital defects(1). The most common type of dental implant is endosseous consisting of a discrete, single implant unit (screw- or cylinder-shaped are the most typical forms of implant ideally used in the clinical set-up) placed within a drilled space within dentoalveolar or basal bone of either maxilla or mandible. Commercially pure titanium or titanium alloy are the common constituents of dental implants which are used in India(2). With the present advancements in the field of implantology, various other materials like ceramics, aluminium oxide along with other alloys (gold and nickel-chrome-vanadium) are also being used(3). Generally, endosseous implants consist of a coating which may comprise a generous amount of plasma-sprayed titanium or a single layer of hydroxyapatite to facilitate early osseointegration process for the patient(3).

'Osseointegration process' was discovered by P.-I. Bra˚- nemark in the year 1969 when by his observation he observed in a rabbit, where a piece of titanium was embedded in the bone which became firmly anchored and difficult to remove(4). Following one year of follow -up observation on the sample, which reported no inflammatory sign in the peri-implant bone region, meanwhile soft tissue had formed a firm attachment to the metal and bone. The Branemark system of dental implants theory was introduced in 1971(5). Subsequently, an estimated data which was obtained, it can be noted that one million endosseous dental implants are placed annually around the globe and with the help of 80 different manufacturers along with the production of 220 implant brands. Dental implants are predominantly placed in primary care settings, commonly in general dental practice under local anaesthesia(6).

Guided bone regeneration is an osteopromotive technique where a cell's occlusive membrane is placed, creating a secluded osteogenic environment by the exclusion of competing soft tissue cells(7).

A lack of small or large, horizontal and/or vertical bone in implant sites may cause major clinical problems in the long run, thus, needs to be corrected prior to implant placement(8). To regenerate enough bone for successful implant placement, a technique known as ridge augmentation is often mandatory prior to the placement of the screw in the socket(9).

One technique of ridge augmentation is Guided Bone Regeneration (GBR), which is widely used in the private clinical set-up. GBR is a surgical procedure involving various barrier membranes with or without particulate bone grafts or/and bone substitutes for its placement. Osseous regeneration by GBR mainly focuses on the migration of pluripotential and osteogenic cells to the bone defect site and adding on with the exclusion of cells impeding bone formation(10). To accomplish the regeneration of a bone defect, the rate of osteogenesis extending inward from the adjacent bony margins must exceed the rate of fibrogenesis growing in from the surrounding soft tissue(11). Generally in a clinical situation, it is often a dilemma to predict the efficacy of ridge augmentation in most of the cases. To ensure successful GBR in the field of implantology, four principles need to be considered, which includes the exclusion of epithelium and connective tissue, space maintenance, stability of the fibrin clot, and primary wound closure(12).

There are various types of membranes used during the course of implantation. Some of them are discussed below(13):

1. Jason Membrane- It is a native collagen membrane basically obtained from porcine pericardium, developed and manufactured for dental tissue regeneration process. The advantageous biomechanical and biological properties of the natural pericardium are preserved during the production process.
2. Periocol Membrane- These membranes have been widely used in the field of dentistry because of their high biocompatibility along with the property of wound healing.
3. Creos Membrane- Creos Xenoprotect is a resorbable collagen membrane recently developed for bone reconstruction, designed to perform low rates of complications.
4. Non-resorbable Membrane- It is made from a non-stick material, where it is quickly coated with plasmatic proteins upon implantation, facilitating cellular adhesion to the membrane surface and forming a hermetic seal. Therefore, resisting the bacteria and epithelial cells migration over and under the membrane.

   Our team has extensive knowledge and research experience that has translate into high quality publications(14),(15),(16),(17),(18–27)(28),(29–31).(32,33)

MATERIALS AND METHODS

It is a single centered retrospective study conducted in a private dental institution, Chennai. The data was collected from the dental hospital management system. 20,000 patient details were analysed between September 2020 to January 2021 out of which 133 patients who fulfilled the inclusion and exclusion criteria were included in the study. Ethical clearance for this study was obtained from the Institutional review board.

The data included a varied population predominantly south Indian. All the case sheets were reviewed and were cross verified by another examiner. The internal validity included diagnosed cases per criteria, medical history, chief complaints and clinical findings.

The data collected was tabulated under following parameters: Age, gender, site, complaint, other investigations, primary metastasis, survival. The independent variable includes age, gender, treatment name, arch involved, GBR usage and type of membrane used. The data analysis was performed using SPSS software of version 23. The chi square test and correlation was done, p value < 0.05 was considered statistically significant.

RESULTS

Dental implants have become increasingly common for the management of tooth loss. Despite their placement in a contaminated surgical field, success rates are relatively high. The drawbacks and complications related to implant therapy are divided into those arena that occur during surgery (such as excessive bleeding or nerve injury), those that occur in the first six months (such as infection and failure to osseointegrate) and those that occur long-run aspect (such as the peri-implantitis and mechanical failures). In the presence of healthy tissues, a well-integrated implant with appropriate biomechanical loads can have 5-year plus survival rates from 93 to 98 percent and 10 to 15 year life spans for the prosthetic teeth. Various long-term studies show a 16- to 20-year success (implants surviving without complications or revisions) between 52% and 76%, with complications occurring up to 48% of the time during its lifespan.

Figure1 illustrates the different age groups of the patients that fulfilled the inclusion criteria. The 18-30 age group consisted of 36.36% of patients, 31-50 age group consisted of 37.88% and the 51-70 age group consisted of 25.76% of the total patient.

Figure 2 demonstrates the gender distribution of the patients. The maximum percentage was opted by male patients (50.76%) followed by female patients (49.24%).

Figure 3 illustrates the various treatment processes involved in patients undergoing implant surgery. The maximum was seen in implant stage 1 surgery (69.70%), followed by socket preservation with 25% and ridge augmentation with 5.30%.

Figure 4 demonstrates the arch involved in the patients undergoing the implant treatment. The maximum amount of treatment was done for patients in the upper arch (71.21%) followed by 28.79% for lower arch.

Figure 5 demonstrates the membrane involved in the patients undergoing the implant treatment. Periocol was maximum used (62.88%), followed by Jason membrane with 20.45%, then Creos membrane as 15.15% and non-resorbable membrane as 1.52%.

Figure 6- Bar graph shows the correlation between age and treatment name involved for which the p value is found to be 0.549 ($p>0.05$) indicating it is statistically insignificant.

Figure 7- Bar graph shows the correlation between age and arch involved for which the p value is found to be 0.417 (p>0.05) indicating it is statistically insignificant.
Figure 8- Bar graph shows the correlation between age and membrane involved for which the p value is found to be 0.224 (p>0.05) indicating it is statistically insignificant.

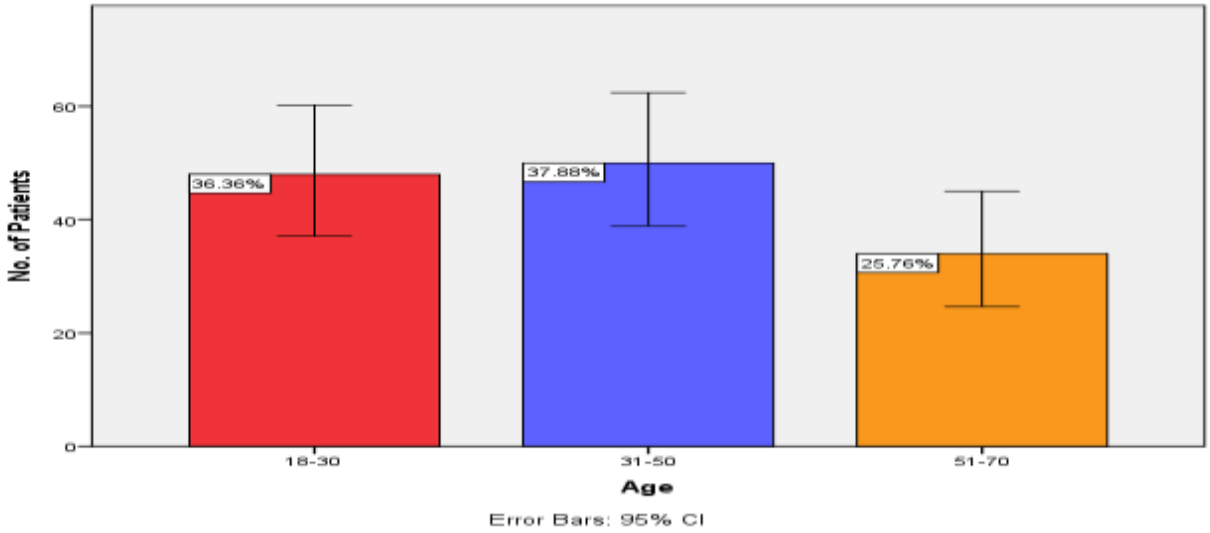

Figure 1: Bar graph represents the age group of patients involved in the study, where x-axis represents the age group of children and y-axis represents the number of patients. The red colour represents the age group from 18-30 years being 36.36%, blue colour represents the 31-50 year age group being 37.88% and 51-70 years as 25.76%.

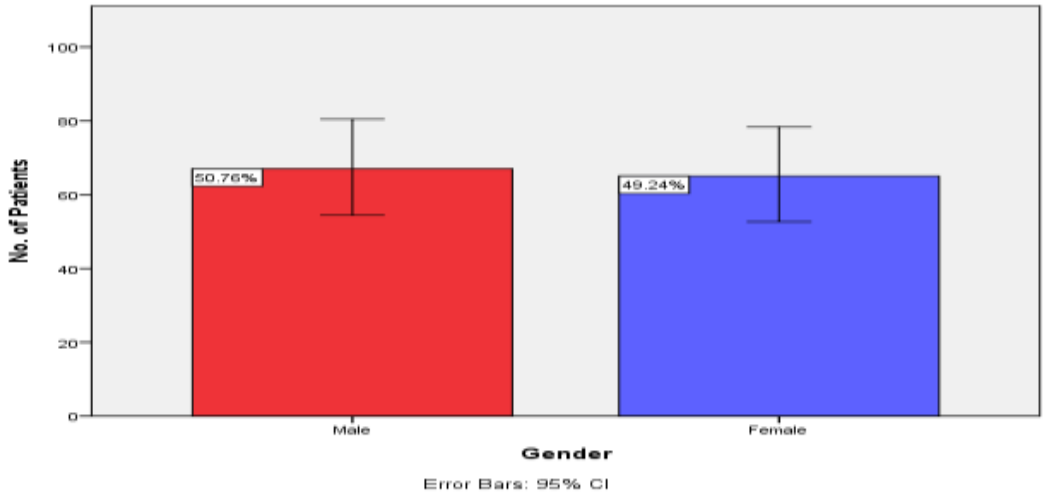

Figure 2: Bar graph represents gender of the patients following in the criterias of the study, where x-axis represents the gender and y-axis represents the number of patients. The red colour represents the male group being 50.76% and blue colour represents the female group being 49.24%

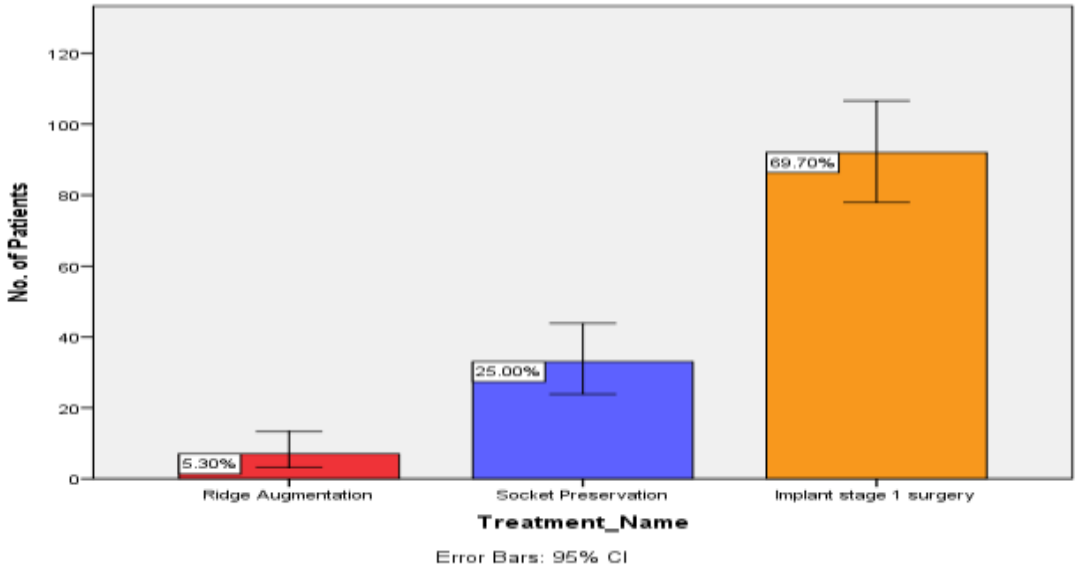

Figure 3: Bar graph represents various treatment names involved while the course of implantation, where x-axis represents the treatment name and y-axis represents the number of patients. The yellow colour represents implant stage 1 surgery being 69.70%, blue colour represents socket preservation being 25% and red color indicates ridge augmentation being 5.30%.

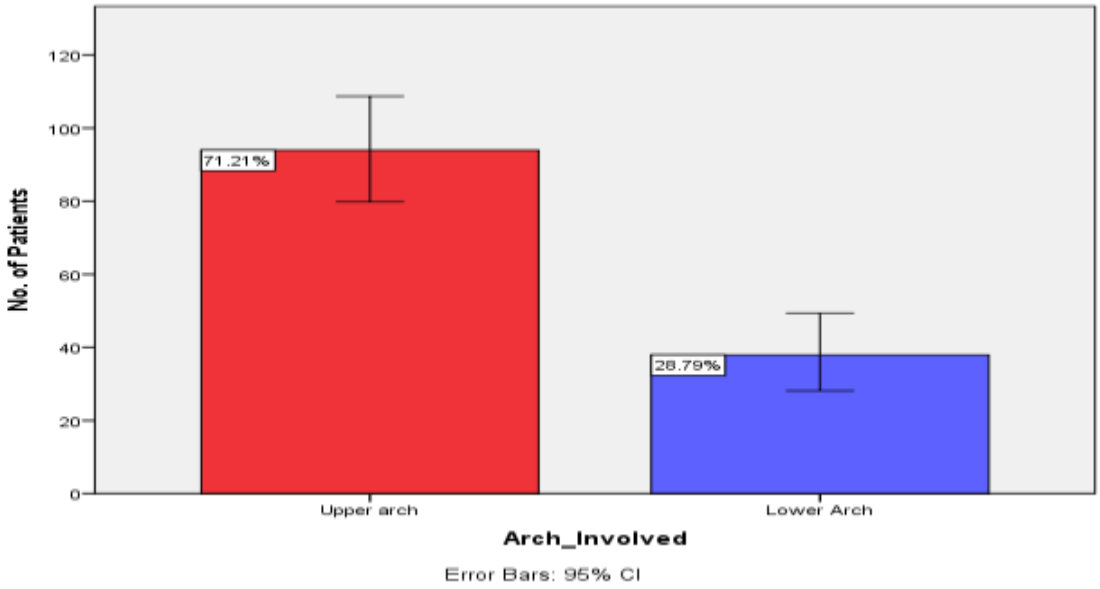

Figure 4: Bar graph represents arch involved for the placement of dental implant, where x-axis represents the arch involvement and y-axis represents the number of patients. The red colour represents the upper arch being 71.21% and blue colour represents the lower arch being 28.79%.

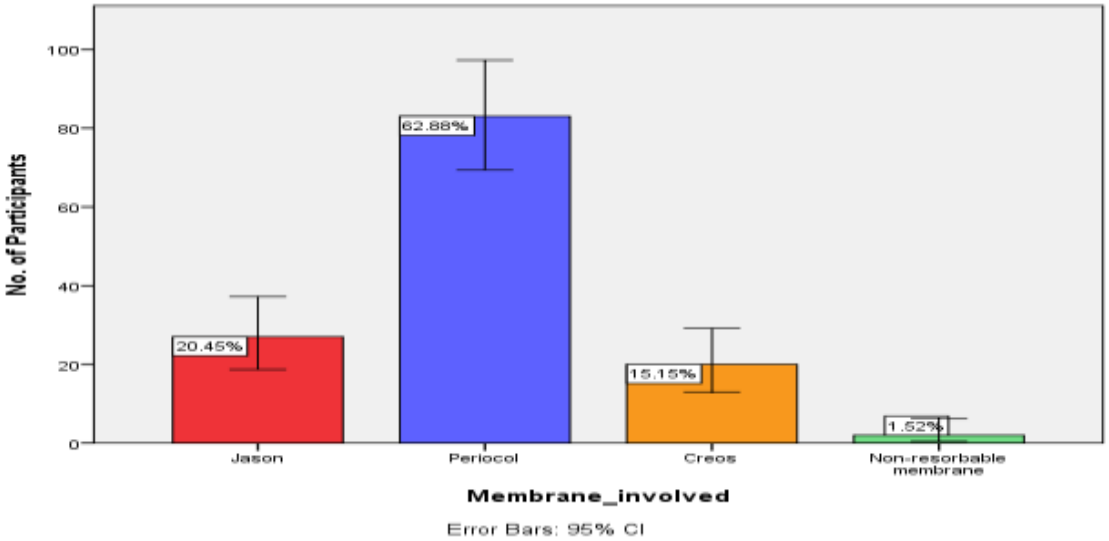

Figure 5: Bar graph represents membranes in implant dentistry, where x-axis represents the membranes involved and y-axis represents the number of patients. The blue colour represents the Periocol membrane being 62.88%, red colour represents Jason membrane being 20.45%, orange denotes Creos membrane as 15.15%, green denotes non-resorbable membrane as 1.52%.

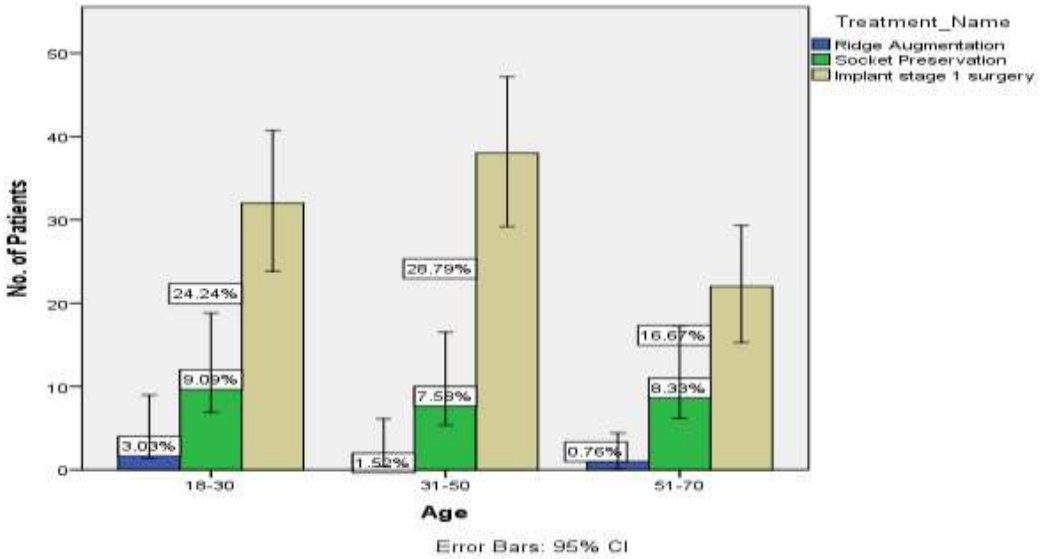

Figure 6: Bar graph depicts the association between age and treatment involved. The X axis represents age and Y-axis represents Treatment name. Blue colour denotes ridge augmentation, green colour indicates socket preservation and yellow colour represents implant stage 1 surgery. Implant stage 1 surgery was the most commonly seen result for all the age groups. The difference was statistically insignificant (Chi-square test; p value = 0.549- insignificant).

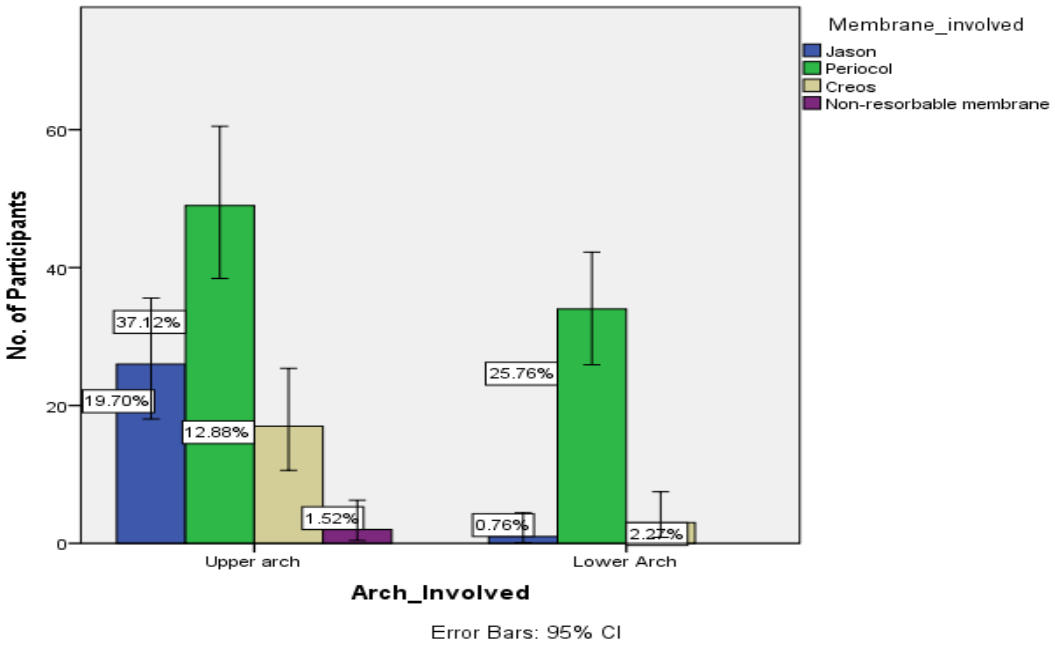

Figure 7: Bar graph depicts the association between membrane involved and arch involved. The X axis represents the arch involved and Y-axis represents the membrane arch involved. Blue colour denotes Jason membrane, green colour indicates Periocol membrane, yellow colour indicates Creos membrane and purple colour denotes non-resorbable membrane. Periocol membrane was the most commonly seen result for both the arches. The difference was statistically insignificant (Chi-square test; p value = 0.001- insignificant).

DISCUSSION

The usage of various membranes in the field of implantology is becoming very crucial because of its vulnerable properties. Various membranes in the field of implantology are used in case of GBR procedures to act as biological and mechanical barriers against the invasion of cells not involved in bone formation, such as epithelial cells, and allow for the migration of the slower-migrating bone-forming cells into the defect sites(34). During the course of bone defects healing, there is a competition between soft-tissue and bone-forming cells to invade the surgical site (soft-tissue cells migrate at a much faster rate than bone-forming cells). Therefore, the primary goal of barrier membranes for the case of implant dentistry is to allow for selective cell repopulation and guide the proliferation of various tissues during the healing process(35). Below the membrane, the regeneration process occurs, which involves angiogenesis and migration of osteogenic cells.

As seen in various previous literatures, the initial blood clot is replaced by woven bone on the initial stage after vascular ingrowth, which later is transformed into load-bearing lamellar bone. As compared to mandible the maxillary arch is mostly fragile in built. During the course of extraction, the alveolar bones on the labial as well as buccal aspects tend to break down easily(36). Therefore, the usage of membranes on the upper arch are seen to the maximum extent. Periocol membranes are highly biocompatible along with the property of wound healing as seen in the present study. In the case of upper arch 37.12% was the usage of Periocol followed by Jason 19.70% . On the other hand, 25.76% was the usage of Periocol membrane in the lower arch making it the best option for the choice of membrane barrier in case of implant dentistry (figure 7) . This ultimately supports hard- and soft-tissue regeneration. If a barrier membrane is not utilized, lack of space maintenance will result in soft-tissue integration and compromised bone growth.

Structural integrity Results of this investigation indicate that the osteopromotive technique described for the process of implantation, using various bioabsorbable membranes in most cases, enables complete bone coverage of exposed implant threads to ensure the longevity of the Titanium screw, whereas partial coverage only is obtained at a minority of implant sites. The defects studied were space-making and comprised buccal dehiscence and fenestration defects. The regenerated tissue consistently demonstrated a superficial layer of compressible fibrous tissue all around the site, when removed and probed, thus enabling revealed bone(37).

Various studies show that a single dental implant can also be used to replace two adjacent teeth. Once the implant has bonded with the body, your dentist will place a two-unit restoration on top of it. A one-stage implant, also known as a non-submersible or single-stage implant, is an endosseous dental implant designed to be placed following a one-stage surgery protocol(38). For all the 3 age groups, the membrane was maximum used in implant stage 1 surgery only with a total of 28.79% for 31-51 years, followed by 24.24% and 16.67% for 18-30 years and 51-70 years respectively (figure 6). The implant is designed with a transmucosal coronal portion. Usually the transmucosal portion and the implant are one

piece with no microgap. When compared to this literature, it was shown that the maximum placement of membrane was done during the course of implant stage 1 surgery with a total of 69.70% as seen in figure 3.

Clinical studies demonstrate that GBR is predictable and successful for horizontal defect augmentation and in most situations this can be achieved using either non-resorbable or resorbable membranes. Resorbable membranes have been considered as user-friendly in most of the clinical aspects. Furthermore, although superior outcome has been revealed using non-resorbable membranes, several reports indicate that such membranes are susceptible to higher complication rates. This has mostly been associated with exposure through the soft tissue A plausible explanation for this complication has been the tension in the soft tissue, in combination with lack of vascular supply. However, the exact mechanisms for membrane exposure are still not fully understood. In the case of exposure of resorbable membranes, spontaneous healing has often been noted, which is possibly a result of the rapid degradation of the membrane rather than regrowth of soft tissue. Therefore as compared with this literature, Periocol membranes are widely used for GBR with a total of 62.88%.

LIMITATIONS

The study that is conducted includes a very small sample size and the outcome depends on the socio-economic status of patients also including the general public who visited the hospital.

CONCLUSION

Membrane's usage in the field of implantology has led to great success of implant placement resulting in the reduction of its failure in the long run. Usage of membranes to a higher extent was appreciated more on the upper arch when compared to the lower due to the fragility of the alveolar bone. Periocol membranes are maximum used followed by Jason membranes because of its remarkable property of structural integrity and biocompatibility. There is a need for further research in this avenue of implantology to design a customised therapy.

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CONFLICT OF INTEREST

The authors declare that there were no conflicts of interest in the present study.

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